

APPENDIX A

SELECTED PROJECT DESCRIPTIONS



## Wetland Delineation and Permit Application, St. Maries Complex, St. Maries, Idaho

### Client:

Potlatch Forest Products  
Corporation

### Contact:

Don Hejna,  
Bernie Wilmarth  
Tel: 218 759-4304

### Key Personnel:

Donna DeFrancesco  
Jim Renner  
Beth Duvall  
Judith Hillis  
Tom Hoffert  
Paul Van Middlesworth  
Tim Martin



The goal of the project is to expand a log storage/sorting yard on the Potlatch St. Maries Complex plywood mill site in Benewah County, ID. The proposed project includes a log storage/sorting yard expansion, construction of road crossing of ditch and stormwater management.

Golder Associates were retained by Potlatch Forest products Corporation in 2007 to complete a wetland delineation of the 50 acre site adjacent to the St. Joe River for the proposed log storage/sorting yard. The project is located within the boundaries of the Coeur d'Alene Indian Reservation. Over 40 acres of floodplain wetland were identified on the site. Golder Associates was retained for subsequent completion of an individual 404 Joint Permit Application related to proposed wetland impacts in the proposed Project Area.

The permit application development was fast tracked and Golder worked cooperatively with Potlatch staff to complete the application on schedule. The following tasks were completed by Golder in April 2007:

- Pre-application with the Corps of Engineers;
- Completion of the Joint Permit Application and supporting material;
- Section 106 - Cultural resources investigation;
- Threatened and Endangered Species information review and biological assessment; Section 404(b)1 Alternatives Analysis;
- Conceptual mitigation plan.



Golder and Potlatch completed weekly progress conference calls and brainstorming sessions; and Potlatch staff provide significant information and review process during the application development to maintain the project schedule and application details.

Golder and Potlatch coordinated with the Army Corps of Engineers, the US EPA, and the Coeur d'Alene Tribe throughout the application process. The application was submitted in early May 2007.

A site visit was completed by Potlatch, Golder and the agencies in July 2007. Minimal comments focusing on only the mitigation plan details were received by the agencies.

The permit application was recently sent for public comment. Golder is currently working with Potlatch to provide additional mitigation plan details to the agencies



## South Fork Coeur d' Alene River Response Actions Kellogg, Idaho

### **Client:**

Silver Valley Natural Resource  
Trustees, Kellogg

### **Contact:**

Marti Calabretta  
Tel: (208) 786-2471  
Chuck Moss  
Tel: (208) 334-3645

### **Key Elements:**

Remedial Investigation  
Treatability Studies  
Alternative Selection  
Remedial Design  
River Stabilization  
Construction Oversight  
Geotechnical Engineering  
Remedial Design  
Monitoring

### **Key Personal:**

Douglas Morell, PhD., L.G., L.Hy.  
Bryony Stasney, L.Hy  
Hank Swift, P.E.  
Frank Shuri, P.E.

Golder Associates Inc. has been assisting the Silver Valley Natural Resource Trustees (comprised of representatives from Idaho State, Shoshone County, several mining companies, the Coeur d'Alene Tribe, BLM, EPA and citizens) to restore the South Fork Coeur d'Alene River and its tributaries for aquatic and riparian life and to reduce human exposure to residual metals in soil and surface water resulting from previous mining practices. The projects are voluntary actions under CERCLA with EPA oversight. Golder has provided a variety of professional services for several projects over the past 5 years including:

- investigation and characterization of soil, surface water and groundwater,
- treatability studies,
- evaluation of remedial strategies,
- remedial designs,
- river channel stabilization,
- groundwater capture and treatment,
- wetland / riparian habitat development,
- negotiations with regulatory agencies and Indian Tribes,
- preparation of contractor bid packages, and
- Construction supervision.

### **Osburn Flats Response Action**

As a result of the floodplain characterization, the Osburn Flats reach of the river was selected by the Trustees as the site for a 1998 remedial response action.



### **Bare Floodplain at Osburn Flats Prior to Floodplain Reconstruction (June 1997)**

Golder assisted the Trustees in the development of the Osburn Flats scope of the work, which included:

- site investigation involving test pitting and soil sampling to determine the extent of the tailings;
- excavation of 90,000 yd<sup>3</sup> of tailings from the active flood plain;
- design and development of a secure tailings repository and cap above the floodplain on a closed tailings disposal area about 0.5 mile haul from the floodplain;
- river stabilization and establishment of a back-bar channel;
- enhancement of wetland/riparian habitats in the floodplain; and,



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- design and implementation of a pilot soil amendment study as a component of upland habitat restoration on the terraces and slopes above the floodplain.

### Interstate Mill Tailing Response Actions

Golder performed all site investigations, designs and bid packages for the remedial actions at the Interstate Mill site during 1998 and 1999. The lateral and vertical extent of the tailings at the site were determined cost effectively (quickly, cheaply and with a high degree of confidence) using test pitting, soil sampling and geophysics. 60,000 yd<sup>3</sup> of tailings were excavated and placed in a hydrologically isolated on-site repository. The repository was designed with a coarse rock basal pad and chimney along the mountain side that elevated the tailings above the groundwater level (100 year creek flood level) and diverted clean surface water run-on beneath the tailings. The tailings were also capped with low permeability soil and armor rock according to NRC design specifications developed to provide 1,000+ years of containment for uranium mill tailings. As a result, the Interstate Mill site repository will need minimal maintenance over the long term. Creek channel and riparian habitat improvements were also completed during these remedial actions. The improvements involved placement of boulders and large woody debris to create sediment trap ponds to encourage the development of riparian vegetation.



Completed Interstate Repository in May 2000

### South Fork Coeur d'Alene River and Floodplain Characterizations

Two projects involved soil and water sampling and discharge measurements along a seven mile reach of the South Fork CdA River and 12 mile reach of CdA River to determine the location and magnitude of non-point source loading of metals to the river. Laboratory analysis of about 150 samples was followed by selected leachability testing of mine tailings taken from active depositional areas in the floodplain. The results were used to prioritize areas to be considered for remedial action and to develop strategies for remedial action implementation and habitat enhancement projects.

### Fisco – Gem Tailings Remediation

Golder designed and developed the bid package for the excavation and removal of about 100,000 yd<sup>3</sup> of tailings impacted soils from Canyon Creek. Tailings were deposited in the Canyon Creek Repository.



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**Dudley CdA River Bank Stabilization Structures**

Golder designed and permitted two 750 ft. in-stream rock structures at Dudley to stabilize bankerosion of tailings impacted soils to the river. Each structure has unique design features and Golder is currently monitoring their effectiveness.

**South Fork CdA River Tailings Removal**

Golder designed and developed a bid package for the excavation and removal of "hot spot" tailings accumulations along the flood plain of the South Fork CdA River. The hot spot removals were located from Silverton to the confluence of Big Creek and were deposited within the CIA in the Bunker Hill Superfund site.



**Client:**

Blackbird Mine Group

**Contacts:**

Dan Myers, Noranda  
Mining, Inc.,  
Tel: (208) 756-8688

Dave Jackson, Coordinator  
for Alumet  
Tel: (303) 838-0700

**Period of Performance:**

1994 to present

**Contract Amount:**

\$13 Million to date

**Key Personnel:**

Mike Brown  
Doug Dunster  
Dave Findley  
Josh Ford  
Lee Holder, P.E.  
Joe Kennedy  
John Liu  
Richard Luark, P.E..  
Dave O'Malley  
Douglas Morell, Ph.D.  
Cheryl Ross  
Frank Shuri, P.E.  
Tom Stapp  
Hank Swift, P.E.  
Stella Swanson, Ph.D.  
Cathy Smith, P.E.  
Lisa Vaughn  
Rens Verburg, Ph.D.

**General**

Golder has conducted Early Response Actions, a Remedial Investigation & Feasibility Study (RI/FS), Ecological Risk Assessment, Removal and Remedial Designs, and Construction

Management and Quality Control services since 1994 at the Blackbird Mine site in Lemhi County, Idaho. The site has been nominated for listing on the National Priorities List (NPL)

under CERCLA and was also the subject of a Natural Resource Damage (NRD) claim and settlement between the mining companies and the Natural Resource Trustees. Golder is also implementing portions of the Biological Restoration and Compensation Plan required by the NRD Consent Decree.



This former copper/cobalt mine was the source of copper and cobalt loading to Panther Creek, a tributary of the Salmon River, due to seepage from acid-generating waste rock piles, tailings and adit drainage. This metals loading resulted in exceedance of water quality criteria and impacted populations of Snake River spring/summer run Chinook Salmon and steelhead trout, both of which are listed as threatened under the Endangered Species Act (ESA). In addition, large volumes of tailings containing unacceptable levels of arsenic were released from the historic mining activities affecting overbank areas on both public and private property along miles of Panther Creek and tributary streams.

The remediation of the site was implemented initially as a series of Early Actions, followed by the RI/FS and biological restoration program. The objective of the Early Action work was to define the most effective alternative, design the work, and construct it to quickly reduce the loading of copper and cobalt to allow re-introduction of anadromous salmonids to Panther Creek. In addition, Early Actions were conducted to remove tailings deposits containing unacceptable concentrations of arsenic from stream banks and deposition areas. In conjunction with and following completion of the Early Actions, investigations were conducted to determine residual metals contamination for the human health and ecological risk assessments and to select and design the final remedy in the RI/FS and Record of Decision, which was issued February 2002.

**Early Actions**

Early Actions were developed based on analysis of alternatives using the Engineering Evaluation and Cost Analysis (EE/CA) process.



## Blackbird Mine Remediation Salmon, Idaho

**Client:**

Blackbird Mine Group

**Contacts:**

Dan Myers, Noranda  
Mining, Inc.,  
Tel: (208) 756-8688

Dave Jackson, Coordinator  
for Alumet  
Tel: (303) 838-0700

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Rens Verburg, Ph.D.

Implementation of Early Actions was complicated by site conditions included mountainous terrain at elevations of 6000 to 7800 feet, and short construction seasons due to winter conditions and heavy snowpack. The Early Actions have resulted in greater than 95% reduction in copper concentrations in Panther Creek. In addition, tailings deposits containing arsenic above human health criteria have been removed from several miles of stream banks and public and private property alongside Blackbird and Panther Creeks. The work included:

- Developed a model for design rainfall (500 yr) and snowmelt (100 yr) events which simulated the storage and subsequent treatment of potentially contaminated water from multiple sources. Storage was provided in the two reservoirs (7100 Dam and 7000 Dam) and in the underground mine prior to treatment. The model was used to optimize diversion and storage facilities and water treatment plant capacity.
- Diversion of clean water above all waste rock dumps to reduce amount of water that required storage and treatment.
- Collection of contaminated surface water and groundwater below waste dumps for treatment.
- Expansion and automation of an existing water treatment plant from 400 gpm to 1,000 gpm.
- Removal of selected waste rock dump and tailings deposits.
- Construction of a cover caps for selected waste rock piles.
- Construction of two large dams (95 ft. high) for collection and storage of contaminated water prior to treatment.
- Construction of two medium size sediment control dams 30 feet high.
- Construction of a 1,400 ft adit to connect the northern basin to the mine.
- A new pump station for the transfer of contaminated springs and seeps.
- Construction of a drainage system in the pit to connect to the underground mine.
- Construction of concrete channel for Meadow Creek to prevent contact with waste rock.
- Construction of off-channel rearing habitat and restoration following tailings removal activities.
- Construction of 2 large Drop Structures for conveyance of stormwater, one was a 2,000 ft long 18 inch HDPE pipe and one was 1,900 ft long with a vertical drop of 460 ft.
- West Meadow Creek Conveyance pipelines; 18 to 30 inch dia., 2300 ft long pipeline.
- Water Treatment Plant Pumpback Pipeline; this 6 inch diameter, 4,000 ft long, pipeline conveys high pressure (300 psi) contaminated water.

**Remedial Investigation**

The RI was conducted concurrently with the Early Actions to identify residual source areas of metals loading and to impacts to environmental media for the



## Blackbird Mine Remediation Salmon, Idaho

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Blackbird Mine Group

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Human Health and Ecological Risk Assessments and to provide information needed to evaluate alternatives in the FS. Work included:

- Several years of stream gauging to determine snowmelt runoff hydrographs and relationship to metals loading and water quality.
- Extensive synoptic surface water sampling combined with flow measurements to determine sources of metals loading.
- Sampling of sediments, surface soils, groundwater, and vegetation.
- Macroinvertebrate studies and multi-metric evaluations of population data to determine biotic indices at impacted and reference locations.
- Electrofishing to determine the recovery and health of fish populations following implementation of Early Actions.

### **Terrestrial Ecological Risk Assessment (ERA)**

Golder recognized that due to the elevated metals present at this mine site, the traditional “bottom up” approach used in Ecological Risk Assessments was likely to show environmental hazard indices (EHIs) that were unacceptable, even though risks at the population level may be insignificant. Therefore, Golder incorporated an innovative “top down” approach in the ERA starting from the planning stage. This approach entailed evaluation of population and community level of effects to ecological receptors of concern. The risk characterization was based on the overall “weight of evidence” using ecological land classification mapping, assessment of habitat suitability, food resource quality, an evaluation of sizes of home ranges and resulting numbers of individuals potentially impacted due to site contaminants. Results of the ERA indicated that no additional remedial actions were needed to address risk to terrestrial ecological receptors.

### **Feasibility Study**

A range of alternatives was evaluated in the FS for final remedy to address residual sources of metals loading. As part of the analysis, detailed evaluations were conducted of the effectiveness of each of the alternatives at meeting water quality goals in area streams. The FS was approved by EPA in 2002 and a Record of Decision (ROD) was issued by EPA in February 2003. The selected action includes additional surface water and groundwater collection and treatment from sources of metals loading, selective removal of overbank deposits and in-stream sediments, natural recovery for most in-stream sediments, capping the tailings impoundment, continued operation of the wastewater treatment plant, and institutional controls.

### **Remedial Design/Implementation**

Remedial Design and Implementation has been occurring concurrently with Consent Decree negotiation to expedite achievement of water quality goals and reintroduction of Chinook Salmon to Panther Creek.





## GE Apparatus Service Shop RI/FS Spokane, Washington

**Client:**

General Electric

**Contact:**

Christopher Allen

Tel: (518) 385-0623

**Key Elements**

- PCB Soil and Groundwater Impacts
- Renegotiated CAP
- 40% Reduction in Remediation Costs

**Key Personnel:**

Doug Morell, Ph.D.

Lee Holder, P.E., FS Leader

Ted Norton, RI

Paul VanMiddlesworth

Bryony Stasney, L.G., L.Hy.

Golder performed site investigation work at a former transformer service shop in Spokane, Washington, where site contaminants were primarily PCBs. The site was remediated pursuant to both CERCLA and MTCA, with the Washington State Department of Ecology being the lead agency. Because of the PCBs, TSCA regulations were also a consideration.

Major project features include:

- Washington State Department of Ecology approval of all project investigation plans, including health and safety, sampling and analysis, and quality assurance project plans.
- Performed on-site analysis for PCBs, tri- and tetra-chloro benzenes, and volatile organic compounds, using project-specific QA/QC procedures.
- Hydrogeological investigations included drilling angled boreholes and vertical holes of varying depths to determine lateral and vertical extent of affected groundwater in relation to the Spokane Rathdrum Prairie sole source aquifer.
- Executed stringent health and safety procedures during all phases.
- Determined extent of impacted soil and water.
- Prepared RI and FS Reports.

Golder prepared the groundwater portion of the RI and associated risk assessment. In the Feasibility Study, Golder developed the approach and technical basis for the groundwater remedy accepted by the Washington State Department of Ecology and the US EPA, which was “no action” with monitoring.

*In situ* vitrification (ISV) was selected as the remedy for soils in the original FS conducted by another consultant. GE had signed a Consent Decree and Cleanup Action Plan (CAP) with Ecology to conduct ISV. The bid cost of ISV was much more than anticipated in the FS, and Golder supported GE in an attempt to renegotiate the CAP. Subsequently, Golder conducted a forensic evaluation of ISV and prepared a Supplemental FS that documented technical problems associated with ISV. Golder proposed a modified remedy that would accomplish remedial action objectives (PCB destruction) more reliably and at less cost. Golder’s modified remedy was accepted by Ecology and was mended to the Consent Decree and CAP, which saved General Electric over three (3) million dollars.

Compliance monitoring for the site is ongoing.



## Pasco Bulk Fuel Terminal State Superfund Site - Pasco, Washington

### Client Contacts:

Crowley Marine Services  
Stephen Wilson  
Tel: (206) 332-8033

Port of Pasco  
Randy Hayden  
Tel: (509) 547-3378

### Key Elements

- Remedial Design
- Remedial Action
- O&M
- Bulk Fuel Tank Farm Demolition
- Large Scale IAS & SVE
- Agency Negotiations

### Key Personnel:

Lee Holder, P.E.  
Doug Morell, Ph.D., L.G., L.Hy.  
Paul VanMiddlesworth  
Doug Dunster

Golder is currently performing soil and groundwater remediation for this large brownfields site in Pasco, Washington. The clients are Crowley Marine Services, Inc. and the Port of Pasco, cooperating as the Pasco Bulk Fuel Terminals Site Coordinating Group. WDOE's Spokane office has the lead for this MTCA site. Contaminants throughout the site are benzene, petroleum hydrocarbons (TPH), non-aqueous phase liquid (NAPL), and polynuclear aromatic hydrocarbons (PAHs). Part of the site also has chlorinated volatile organic compounds (VOCs).

Golder was retained after completion of the RI/FS and remedy selection to comment on the draft Cleanup Action Plan (CAP). In reviewing the site data and the proposed remedy, Golder discovered that the proposed remedial technologies would not meet all of the proposed cleanup levels. Golder then renegotiated the cleanup levels, using WDOE's Interim TPH Policy, so that the proposed remedy could achieve the cleanup levels.

Golder also negotiated a revised, flexible remedy that allows using an innovative "adaptive management" approach to remedial design/remedial action (RD/RA). In general, Golder's adaptive management approach implements the remedy in a step-wise manner. Thus, results of the initial phases of remedial action have been used to optimize subsequent RD/RA.

Demolition of the Main Tank Farm has been successfully completed. Golder prepared the demolition bid package, conducted bidding, and served as Owner's Representative for the work.

After the Cleanup Action Plan (CAP) has been finalized, Golder prepared the remedial action plans for the site, including the Engineering Design Report and Compliance Monitoring Plan. Golder then prepared the detailed design of the remediation systems, which has been approved by the regulators. Golder installed the treatment systems and is currently performing the operation, maintenance, and monitoring for the site.

Treatment consists of in-situ air sparging (IAS) and soil vapor extraction (SVE), with limited pump-and-treat.





## White King/Lucky Lass Mines Superfund Site Lakeview, Oregon

### **Client:**

Tronox Incorporated  
Western Nuclear, Inc.  
Fremont Lumber Company

### **Key Elements:**

Ecological Risk Assessment  
Remedial Design  
Construction Management  
Groundwater Monitoring

### **Key Personal:**

Lee Holder, P.E.  
Frank Shuri, P.E.

This CERCLA site consists of two former uranium mines in south-central Oregon. Constituents of concern include radioisotopes (primarily uranium and radium) and arsenic. Golder was retained after completion of the RI/FS to provide (1) design and construction management for the remedy, and (2) biological studies related to water and sediment quality. Golder first prepared workplans which were approved by the agencies.

The lead agency is the U.S. EPA (Region 10 office). Other agencies involved are the U.S. Forest Service, the Oregon Department of Environmental Quality, and the Oregon Department of Energy.

Golder prepared the remedial design of the remedy, which included consolidating mining overburden stockpiles and capping the combined stockpile. As part of this effort, Golder performed pre-design investigations in 2004 to identify local cap materials and to identify “off-pile” mine wastes to be removed to the combined stockpile. The remedy included restoration of the creek to its natural channel and wetlands development.

The ROD identified unresolved concerns over potential impacts to stream sediments and bioaccumulation of metals. Golder performed field tests of bioaccumulation using mussels, and evaluated appropriate aquatic biological habitat goals. Based on the results of these biological studies, EPA accepted Golder’s finding that no remediation was necessary for the pond or creek.

Golder provided construction management (CM) and construction quality assurance (CQA) in 2004 for initial site work and for construction of the remedy begun in 2005 and completed in 2006. More than 600,000 cubic yards of contaminated soil was moved during the work.





## Pend Oreille Mine RI/FS Pend Oreille County, Washington

**Client:**

Teck Cominco American  
Incorporated

**Contact:**

David Godlewski  
Tel: (509) 892-2584

**Key Elements:**

- MTCA, RI/FS
- Metals
- Tailings Impoundment Stability Analysis
- Human Ecological Risk Assessment

**Key Personnel:**

Doug Morell, Ph.D., L.G., L.Hy.  
Paul VanMiddlesworth  
Bryony Stasney, L.G., L.Hy.  
Mike Brown, P.E.

Golder is performing a RI/FS for Teck Cominco American Incorporated to recommend the optimal remedial action that satisfies the Washington State Model Toxics Control Act (MTCA) and provides available land for acceptable use to the area and community. The Spokane office of the Washington State Department of Ecology (Ecology) is the lead oversight agency on the project. A Public Participation plan is being implemented using a community outreach to inform and educate the public at the important stages of the project and to solicit input from the host community, particularly on the future land use for the facilities.



TDF-1 and TDF-2 are hundreds of feet in elevation above, but only about 600 feet horizontally from the Pend Oreille River. Golder is evaluating the potential for mass failure of the impoundments from seismic events. This evaluation is important for evaluating necessary remedial actions, the long-term stability of the impoundments and protection of the River.

In order to satisfy MTCA, the remedial actions must reduce risk to human health and the environment to acceptable levels. Currently, the only operable pathway for human health risks appears to be direct contact/incidental ingestion with tailings in TDF-1 and TDF-2. In review of the available reports, data indicate there may be elevated metals (lead and zinc) in the sediments in the creek draining the tailings impoundments and in the wetlands on TDF-1. The surface water quality is being tested for potential exceedence of hardness adjusted ambient water quality criteria for dissolved metals. We will be conducting a tiered approach to evaluating terrestrial and aquatic ecologic risks. The first tier is to score the site to determine if it qualifies for an exemption to conducting an ecologic risk evaluation and the second tier is a comparison of soil concentrations to screening levels. Because existing site information indicates the site will not pass the requirements for an exemption and the tailings concentrations are above screening levels, a detailed site specific terrestrial risk assessment will be conducted. Risks to terrestrial ecology potentially may exist from direct contact to tailings, through ingestion of vegetation, or through ingestion of insects and borrowing animals. Although browsing or grazing wildlife has the potential to be exposed to metals from the tailings impoundments through plant uptake, much research has been done at similar mine sites that indicate plant uptake may be minimal when the soil is alkaline.





## Water Treatment at the Success Mine and Mill, Wallace, ID.

### Clients:

Idaho Department of  
Environmental Quality

Terragraphics Environmental  
Engineering

### Contacts:

Rob Hanson,  
Idaho Department of  
Environmental Quality,  
Boise, ID  
Tel: (208) 373-0502

Luke Russell,  
Idaho Department of  
Environmental Quality,  
Kellogg, ID  
Tel: (208) 783-5781

Jerry Lee,  
Terragraphics,  
Moscow, ID  
Tel: (208) 882-7858

### Key Personal:

Doug Morell, Ph.D., L.G., L.Hy.  
Bryony Stasney, L.G., L.Hy.  
Hank Swift, P.E.  
Lee Holder, P.E.

The Success Mine and Mill site, a 200 to 350 thousand cubic yard tailings pile, contributes significant cadmium, lead and zinc loading to the South Fork of the Coeur d'Alene River. Between 2000 and 2002, Golder assisted the Silver Valley Natural Resource Trustees with identification of a semi-passive treatment system, pre-design investigation, design and bid assistance, construction oversight and effectiveness monitoring. Since May 2002, operations, maintenance and monitoring of the site has been the responsibility of the Idaho Department of Environmental Quality (DEQ).

The overall concept of the semi-passive system is: 1) to intercept impacted, shallow alluvial groundwater before it discharges to the East Fork of Ninemile Creek (a tributary of the South Fork Coeur d'Alene River); and, 2) to reduce the concentrations of cadmium, lead and zinc within the intercepted groundwater prior to discharging the water into the creek. A 1,400-foot grout cutoff wall and hydraulic drain system was constructed between the tailings pile and the creek. A groundwater treatment vault was installed at the downgradient end of the wall. The groundwater is directed to a treatment vault comprising two 50- by 6- by 13-foot high cells containing fishbone apatite. Fishbone apatite was selected from a number of media types tested at the bench scale by the Idaho DEQ.



Golder has provided effective monitoring services at the site from January 2001 to date. Services have included:

- Preparation of an effectiveness monitoring plan with review from EPA, USGS and IDEQ;
- Monthly monitoring of cadmium, lead and zinc at the vault inflow and outflows;
- Quarterly monitoring of phosphorus (total phosphorus, total dissolved phosphorus and dissolved orthophosphate) and nitrogen (ammonia, nitrite, nitrate and TKN) within the creek upstream and downstream of the site; and,
- Quarterly monitoring of *E. coli* and *Enterococci* within the creek downstream of the site.

To date, the fishbone apatite treatment media has reduced cadmium, lead and zinc concentrations in treated groundwater by over 95%. Ongoing work at the site is focusing on the potential impacts of phosphorus and nitrogen release on the primary productivity of the creek with the objective of assessing if this nutrient release will be bound within the upper Coeur d'Alene basin or if the nutrients have the potential to travel through the surface water system and ultimately reach Coeur d'Alene Lake.





## Facility Investigation and Corrective Measures Study Anacortes, Washington

### Client:

Tonkon Torp, LLP

### Key Elements:

RCRA Facility  
Investigation/Corrective  
Measures Study

Deep Well Injection

Assessment of Potential  
Discharges to marine Estuary

Remedial Design

EPA Negotiations

### Key Personal:

Lee Holder, P.E.  
Frank Shuri, P.E.  
Gary Zimmerman  
Doug Dunster  
Douglas Morell, PhD., L.G., L.Hy.

Golder Associates Inc. performed an RCRA Facility Investigation and Corrective Measures Study (RFI/CMS) at this site located at March Point near Anacortes, Washington. Work is being conducted pursuant to a Consent Order with EPA. The facility formerly manufactured phenols and cresols from petroleum refinery feedstock. Historic waste management practices included use of surface impoundments and underground injection wells that resulted in contamination of soil and groundwater. Golder conducted hydrogeologic investigations, including installation of nested multiple depth monitoring wells and evaluated the influence of tidal fluctuations on groundwater and contaminant movement. Site maps were prepared using photogrammetric mapping with 1-foot horizontal contouring.

The primary concern is the potential to impact offsite residential supply wells and/or discharges to Padilla Bay. Investigations to date by Golder have indicated that the impacted groundwater has not migrated to offsite receptors. Additional investigations have been proposed and are pending review and approval by EPA. Golder has also designed an onsite stormwater treatment system. Natural attenuation will be



evaluated as a remedial alternative. Golder also assisted in finalizing RCRA Closure Plans and obtained approval of final closure from the Department of Ecology for some waste management units at the site.



## Dad's Auto Wrecking Remedial Investigation Ponderay, Idaho

### Client:

Idaho DEQ  
Coeur d'Alene, ID  
Tel: (208) 769-1422

### Key Elements:

- Environmental Assessment
- Remedial Investigation
- Corrective Action Measures

### Key Personnel:

Tim Martin, P.E.  
Paul VanMiddlesworth

Golder was retained by Idaho Department of Environmental Quality to assess the nature and extent of hazardous substances and petroleum product releases from a former car crushing operation located at Dad's Auto Wrecking Yard in Ponderay, Idaho. The scope of this investigation concentrated on a target area proximal to the former portable car crusher unit with the objective of collecting sufficient surface and subsurface soil and groundwater samples to characterize any release(s) to the environment. Based on the former car crushing activities, potential contaminants of concern included a full range of petroleum hydrocarbon products associated with motor vehicles (gasoline through heavy oil ranges), lead from leaded gasoline as well as scrapped battery plates, and mercury from scrapped mercury switches.

Golder determined that site geologic conditions indicated that the very fine-grained texture of the subsurface soils had prevented the vertical migration of contaminants released during the car crushing activities, evidenced by the lack of contaminants found below the upper 2 feet of impacted soils. Near-surface soil impacts were found to be constrained to the immediate vicinity of localized surface spills from drums containing mixed oily-waste from the car crushing activities and the mobile fluid receptacle used during car crushing activities at the Site. Furthermore, groundwater analytical results indicated that no groundwater impacts had occurred as a result of the car crushing activities on the site.



Golder's recommendations included the removal of the top 2-feet of soil in the areas of petroleum impacts found in the immediate vicinity of the oily-waste drums (approximately 20 cubic yards), as well as the removal of the top 0.5-feet of soil across the entire target area (approximately 30-cubic yards). Additionally, Golder recommended removing and disposing of 15 drums containing mixed oily-waste fluids in the target area of the Site.

**Client:**

JLZ Enterprises  
Sagle, ID  
Tel: (208) 610-8218

**Key Elements:**

- LUST Site Investigation
- UST Removal and Closure
- Remedial Investigation
- Corrective Action Plan

**Key Personnel:**

Tim Martin, P.E.  
Hank Swift, P.E.  
Paul VanMiddlesworth

Golder was retained by JLZ Enterprises to determine the status of an IDEQ Ordered cleanup and remediation of a leaking underground storage tank (LUST) on a commercial property located adjacent to the Pend Oreille River in Priest River, Idaho. Golder first examined the current groundwater and soil treatment systems consisting of air sparging wells, soil vapor extraction system, and an on-site air stripper system previously constructed on the site and determined them to be improperly constructed and functioning inefficiently to effectively remediate site hydrocarbon impacts within a reasonable time frame allowed by state and federal regulators. Next, Golder presented a variety of cost-effective remediation methods to clean up the petroleum-impacted soils at the Site and mitigate groundwater impacts to the Pend Oreille River waters in order to protect human health and the environment and bring closure to site remediation.

Based on the levels of petroleum hydrocarbon components exceeding Site-Specific Target Levels (SSTLs) determined for the site through Idaho DEQ Risk-Based Cleanup Guidance, Golder determined that excavation and off-site disposal of the petroleum contaminated soils would be the most cost-effective remedy for the site. Golder prepared a site work plan for UST closure, geometry and approach for soil excavation, off-site disposal of petroleum contaminated soils, collection and analysis of soil confirmation samples, and post-remediation groundwater monitoring activities that were approved by the client and Idaho DEQ.



Golder's recommendations and corrective actions allowed for the timely removal of residual petroleum sources, closure of the two remaining USTs on the site, closure of site remediation activities to Residential Cleanup Levels, as well as reduction of site remediation costs by over \$800,000.



**Client:**

Silver Valley Natural  
Resource Trustees

**Contacts:**

Chuck Moss  
Executive Office of the  
Governor,  
State of Idaho, Boise, ID  
(208) 334-3645

**Key Personnel:**

- Doug Morell, Ph.D
- Hank Swift, P.E.
- Bryony Stasney, L.Hy.

Golder Associates Inc. (Golder) assisted the Silver Valley Natural Resource Trustees (comprised of representatives from Idaho State, Shoshone County, several mining companies, the Coeur d'Alene Tribe, BLM, EPA and citizens) to restore the South Fork Coeur d'Alene River and its tributaries for aquatic and riparian life and to reduce human exposure to residual metals in soil and surface water resulting from previous mining practices. Golder provided engineering and scientific services for several voluntary action projects under CERCLA with EPA oversight between 1996 and 2002. The Dudley Riverbank stabilization pilot project is one of these actions.

The purpose of the Dudley pilot project was to evaluate the effectiveness of using riprap armor rock berms to reduce erosion and subsequent bank collapse of banks along the lower Coeur d'Alene River caused by undercutting from boat wakes. Bank collapse along reaches of the Coeur d'Alene River where mine tailings are present may contribute to loading of heavy metals to the river and ultimately to Coeur d'Alene Lake.

Golder designed and permitted two 750-foot long in-stream rock structures at Dudley to stabilize bank erosion of tailings impacted soils to the river. The structures were placed in late 1999 between the main river channel and the eroding riverbank to allow long-term formation of stable wetland ecosystems at the toe of the bank. The rock was placed using a tracked excavator stationed on a small barge. The barge was moved and positioned using a small tugboat. The objective was to provide permanent bank stabilization without adversely affecting river flow or fish habitat.

Subsequent monitoring in 2000 and 2001 indicated that very little bank erosion had occurred and that vegetation had started to develop between the toe of the bank and the rock berm structures.



**Coeur d'Alene Riverbank Stabilization Structure at Dudley Landing  
(January 2001)**

**Client:**

Del Monte Fresh Produce,  
Inc.  
Oahu, Hawaii

**Contact:**

Eduardo Littleton  
Tel: (808) 621-1220

**Period of Performance:**

1996 - Ongoing

**Contract Amount:**

>\$1,900,000

**Key Project Elements:**

- Hydrologic characterization
- Fractured Bedrock Aquifer
- Basalt Geology
- Groundwater monitoring Plans
- Groundwater Monitoring

**Key Personnel;**

Doug Morell, Ph.D.  
Doug Dunster  
Gary Zimmerman  
Lee Holder, P.E.

As a result of a spill of agricultural chemicals, EPA placed the Del Monte Corporation (Oahu Plantation) Superfund Site on the National Priorities List (NPL) in December 1994. Golder prepared the CERCLA Remedial Investigation and Feasibility Study (RI/FS) for this site, located within a 6,000 acre pineapple plantation on the island of Oahu. Based on the FS, a Record of Decision (ROD) was issued by EPA specifying the remedy. Golder then performed the remedial design, and is assisting in construction, startup and performance evaluation of the remediation treatment systems.

The RI investigated the nature and extent of ethylene dibromide (EDB) and 1,2-dibromo-3-chloropropane (DBCP) impacts to the basal aquifer beneath the site. The basal aquifer occurs at a depth of approximately 850 ft below ground surface and is part of the Pearl Harbor Basal Aquifer system, a large and highly productive regional groundwater resource which serves as the island's primary potable and agricultural water supply. Investigative activities at the site focused on defining the source of the EDB/DBCP impacts to the basal aquifer, and on determining whether the Kunia Well's annulus provided a conduit for direct communication between a highly impacted, shallow, perched aquifer and the deeper basal aquifer. Vertical chemical profiling of the Kunia Well water column, downhole geophysics, analyses of historical analytical data and perched aquifer sampling indicated that, while the Kunia Well may have served as a conduit previously, the current contaminant source to the basal aquifer is area wide infiltration from the perched aquifer and from fumigant application to agricultural fields. The perched aquifer is comprised of saprolite on top of the basalt bedrock.

A key obstacle to conducting the RI was the collection of sufficient basal groundwater data given the great depth to groundwater and resulting high drilling costs (~\$250,000/well). In part due to this cost consideration, basal well drilling was limited to one basal well during each investigative phase, and the nature and extent of basal EDB and DBCP impacts were determined through predictive fate and predictive analyses during each phase for refining the hydrogeologic conceptual model. Golder designed and overviewed the installation of each basal well and most of the perched aquifer wells. Modeling was conducted initially using the US Air Force's BIOSCREEN spreadsheet flow. BIOSCREEN was modified to allow incorporation of probabilistic inputs based on site and regional data, and the consideration of uncertainty into the modeling exercise. Recently, Golder developed a comprehensive three-dimensional flow and transport model using the USGS MODFLOW code for the regional basal aquifer including basalt layers. The MODFLOW model is used for analyzing hydraulic pump tests and determining the capture zone created from basal aquifer extraction at 750 gpm. The results indicated that, despite limited spatial data from wells and model input uncertainty, there was a high likelihood no existing downgradient large-capacity municipal drinking water supplies were threatened.

The FS looked at a range of alternatives for both a perched aquifer system and the basal aquifer. For the perched aquifer, the selected remedy involves a combination of soil vapor extraction (SVE) in combination with groundwater extraction. The highly-impacted, but low transmissive perched groundwater is treated in an on-site phytoremediation system. The remedy for the highly transmissive, but low-impacted basal aquifer involves groundwater extraction and treatment for the source area, and monitored natural attenuation (MNA) for the downgradient area.



Golder designed a 1000-gpm groundwater treatment system for basal aquifer source control, which has been approved by the EPA. Golder has assisted in construction and startup of this system. Golder performed a pilot test for SVE treatment of the perched aquifer, and is currently designing the full-scale SVE system.

Golder is currently finishing remedial actions and conducting compliance monitoring at the site. The perched aquifer groundwater and phytoremediation system has been operational since 2001, which has significantly dewatered the perched aquifer. The perched aquifer SVE system is being designed for installation and operation to remove residues from the dewatered perched matrix soils. The basal aquifer groundwater extraction and treatment system has been installed and is fully operational since September 2005. The capture zone is being continually monitored with pressure transducers. A Work Plan is currently being approved by Region IX EPA for evaluating the contribution of fumigants to the basal aquifer from area-wide normal application to agricultural fields.

**Client:**

Landsburg PLP Group

**Contact:**

Bill Kombol

Tel: (360) 432-4700

**Key Elements**

- Remedial Investigation
- Feasibility Study
- CAP Negotiations
- Large PLP Group
- Trench Capping

**Key Personnel:**

Douglas Morell, Ph.D., R.Hg.

Frank Shuri, P.E.

Gary Zimmerman

Golder Associates was retained by the Landsburg Potentially Liable Party (PLP) Group to conduct an RI/FS for the Landsburg Mine site, a Washington State Priority Listed site being investigated under MTCA. The site consists of an abandoned underground coal mine that was mined until approximately 1975. As a result of underground mining of the near vertical coal seam to depths up to 750 ft, a subsidence trench developed on the land surface above the mine workings. This trench, some 60 ft deep, 100 ft wide and 3/4 mile long, was used for the disposal of various industrial waste materials, construction materials, and land-clearing debris.



*Landsburg Mine Subsidence Trench*

An estimated 4,500 drums and about 200,000 gallons of oily waste water and sludges were disposed into the trench. The RI focused on pathways of chemicals potentially exiting the mine, rather than on characterizing the contents of the mine itself. Field activities included the installation of groundwater monitoring wells at points of expected mine groundwater discharge, four quarters of groundwater sampling at area monitoring, private and public supply wells, geophysical surveys down the centerline of the trench to identify areas of potential buried waste, air monitoring, and surface soil sampling. The major conclusion of the RI was that chemicals are not exiting the mine but are confined to those portions of the trench which were used for waste disposal.

As a result, the FS, which consisted of evaluations of potential remedial alternatives for site cleanup, focused on capping alternatives rather than excavation. Golder assisted the Department of Ecology in the presentation of the RI/FS results to the public, and in the preparation of the Cleanup Action Plan documenting selection of the site remedy. Golder is currently negotiating the Cleanup Action Plan (CAP) on behalf of the PLP Group. The CAP is on the final draft and the preferred alternative consists of backfilling the trench to grade, capping with a low-permeability soil cover, and long-term groundwater monitoring to confirm that waste materials do not exit the mine in the future, which was accepted by the Washington State Department of Ecology.

**Client:**

City of Moses Lake, WA

**Contact:**

Gerry McFaul

Tel: (509) 766-9217

**Key Elements:**

- MTCA, RI/FS
- Petroleum Hydrocarbon Remediation
- Confirmatory Monitoring Complete
- Ecology Eastern Regional Office

**Key Personnel**

Doug Morell, Ph.D., L.G.,  
L.Hy.

Lee Holder, P.E.

Ted Norton

Paul VanMiddlesworth

Bryony Stasney, L.G., L.Hy.

Golder Associates has been retained by the City of Moses Lake since 1989 for various projects to perform hydrogeologic investigations related to various water supply and wastewater functions. The studies have focused on various aspects of the shallow alluvial and deep basalt aquifer systems present in the vicinity. Golder's work has included:

- A baseline hydrogeologic analysis of the basalt aquifer system;
- An initial assessment of the source of trichloroethylene (TCE) detected in three of the City's high-capacity production wells located adjacent to Larson Air Force Base;
- A remedial design recommendation and field oversight of well modifications to eliminate TCE in two of the City's wells;
- Siting and installation of a new 1,300 foot deep 16-inch diameter well installed in the Grande Ronde basalt;
- Wellhead protection area delineation for two of the City's wells;
- Hydrogeologic assessment of the Sand Dunes Wastewater Treatment Plant; and,
- Characterization and remediation of petroleum hydrocarbon in soils and shallow groundwater at the City's Maintenance Facility.

Through a combination of field studies and integration of existing data, Golder has provided technical assessments of local and regional groundwater flow systems, local and regional water quality, well completions, groundwater monitoring requirements, shallow/deep aquifer interactions, and groundwater surface water interactions.



**Drilling Monitoring Wells at the Moses Lake Sand Dunes Wastewater Treatment Plant**



## Water Quality and Loading Analyses, Coeur d'Alene River, Idaho

### **Client:**

Silver Valley Natural  
Resource Trustees

### **Contacts:**

Chuck Moss  
Executive Office of the  
Governor,  
State of Idaho, Boise, ID  
(208) 334-3645

### **Key Personnel:**

Hank Swift, P.E.  
Bryony Stasney, L.Hy  
Doug Morell, Pd.D., L.G., L.Hy  
Frank Shui, P.E.

The Silver Valley Natural Resource Trustees (SVNRT) was formed in 1986 to administer a \$4.5 Million settlement between the State of Idaho and mining companies within Northern Idaho's Silver Valley. The SVNRT comprised representatives of the State of Idaho, Shoshone County, Asarco, Sunshine Mining and Refining and citizens of the Silver Valley. The SVNRT were assisted by a technical team of federal (EPA), state (ID Fish and Game and Idaho Department of Environmental Quality), tribal (Coeur d'Alene Tribe), private (Hecla Mining Company) and citizen stakeholders. The objective of the SVNRT and their technical team was to improve the water quality and fish habitat of the South Fork of the Coeur d'Alene River. A number of projects including water quality sampling and loading studies, floodplain tailings removals and restoration, river bank stabilization and construction of repositories were completed between 1996 and 2002 to meet this objective. Golder provided environmental engineering and scientific consulting services to the SVNRT on these projects between 1997 and 2002.

The SVNRT water quality and loading study involved proportioned surface water sampling and discharge measurements along a 7-mile reach of the South Fork of the Coeur d'Alene River and 12-mile reach of Coeur d'Alene River in August and September 1998. The study objective was to identify the location and magnitude of non-point source loading of metals to the river.



**Tailings Impacted Sediments in banks of the Coeur d'Alene River**

The components of the study included: workplan development; reconnaissance sampling and screening; selection of seven river cross sections; discharge proportioned water quality sampling for chemical and physical parameters; water quality data evaluation; and, metals loading analyses.

The project results indicated that no significant inflows of impacted groundwater nor metals rich sediment from river bank erosion could be identified during low flow along this 17 mile river reach. These results were used to prioritize areas to be considered by the SVNRT for remedial action and to develop strategies for remedial action implementation and habitat enhancement projects.



**Client:**

Avista Utilities  
Noxon, Montana

**Contact:**

Joe Dossantos  
Aquatic Program Leader  
Phone: (406) 847-2729  
Fax: (406) 847-2265

**Key Personal:**

Donna DeFrancesco

Located in northern Idaho, the Pack River is the second largest tributary to Lake Pend Oreille and contains important spawning and rearing habitat for bull trout. Westslope cutthroat, a species of concern, are also present in the drainage. The lower Pack River however, is water quality limited (303(d) listed) due to excess sediment and nutrients. The Pack



River also contributes the highest per-acre loading of nitrates and phosphorous to Lake Pend Oreille.

In order to develop a framework for a Pack River Watershed Management Plan and TMDL, Golder Associates completed a stream inventory of 40 miles of the Pack River.

A Rosgen Level II approach was utilized to characterize basin geomorphology and classify stream type - measuring gradient, cross-section, flood-prone zone, entrenchment, sinuosity, and streambed particle size distribution.

The Forest Service R1/R4 fish habitat inventory was utilized to characterize in-stream fish habitat, measuring individual habitat unit areas, and quantity and quality of large woody debris. To characterize riparian habitat, the Forest Service riparian greenline survey methodology was utilized.



The Pack River stream characterization provides Avista and the Pack River Technical Advisory Committee (TAC) with:

- 1) An inventory of existing conditions,
- 2) An identification of problem areas,
- 3) An evaluation of functions of resources,
- 4) And recommendations for management and restoration of ecological functions, where needed.



**Client:**

Watershed Consulting  
Whitefish, MT

**Contact:**

Amy Chadwick  
Water Quality Specialist  
Phone: (406) 852-3565

**Key Personal:**

Donna DeFrancesco

The Ruby River watershed, located in southwestern Montana, had 27 stream segments on 26 waterbodies identified as impaired or threatened on the state's 303(d) list of water quality limited streams.

Probable causes of impairment in the watershed include sediment, metals, thermal modification, and nutrients. Total Maximum Daily Loads (TMDLs) are required for all listed waterbodies unless documentation and data review indicate that all beneficial uses of the waterbody are fully supported.



Golder Associates was contracted as part of a team to complete a water quality data review and characterization for the Ruby River watershed as a precursor to development of the TMDLS.



Golder's services included:

- Summary of historic water quality and watershed condition
- Format and review of Access database of all known water quality data for the watershed
- Visual representation of water quality data by parameter type, agency, exceedance ranges, etc
- Development of an interactive GIS-information tool linked to an updateable Access database containing all watershed water quality information